

TOPEX/POSEIDON Precision Orbit Determination: "Quick-Look" Operations and Orbit Verification

1., A. Cangahuala*, E. J. Christensen†, B. G. Williams", P. J. Wolff*

This paper presents a summary of the TOPEX/Poseidon "quick-look" orbit determination and verification activities. The primary feature of this endeavor is that orbits are produced with small radial position errors (-5 cm RMS), on a short production schedule (≤ 4 days), with minimal resources.

The TOPEX/Poseidon spacecraft, launched on 10 August 1992, has gathered precise sea-level measurements for over two years. To take advantage of the quality of these measurements, the radial orbit component must be known to better than a decimeter. In order to aid some constituents of the science data user community, orbits are generated as quickly as possible, usually within four days. These orbits are also used for the production of Interim Geophysical Data Records (IGDRs). The primary time-limiting step in "quick-look" orbit production is the collection of the two-way laser tracking data from the world-wide tracking network. The orbits are also used for the verification of precision orbit ephemerides (POEs) used for the final production of geophysical data records (GDRs). In addition, estimates of empirically defined non-gravitational accelerations are supplied to the navigation team for their ground-track maintenance activities,

These orbits are called "Medium Precision Orbit Ephemerides" or MOEs. The strategy for the MOE is to fit three days of laser tracking data with the middle day being the only period used for IGDRs. Hence, each three-day fit overlaps the preceding one by two days. This technique provides some immunity from "end effects" of the fit where accuracy is usually not as high as that for the mid-portion of the data arc. The overlap also provides a continuing quality check on orbit precision as new data is added each day. The orbit determination strategy includes estimating the spacecraft initial position and velocity along with daily values for along-track and cross-track empirical forces. A force model summary and orbit estimation history are given.

* Member of the Technical Staff, Navigation Systems Section, Jet Propulsion Laboratory, California Institute of Technology, 4800 Oak Grove Drive, Pasadena, California 91109.

† Deputy Project Scientist for TOPEX/Poseidon Project and Member of the Technical Staff, Tracking Systems and Applications Section, Jet Propulsion Laboratory, California Institute of Technology, 4800 Oak Grove Drive, Pasadena, California, 91109.

" Technical Group Supervisor, Navigation Systems Section, Jet Propulsion Laboratory, California Institute of Technology, 4800 Oak Grove Drive, Pasadena, California, 91109.